Hemisphere GPS®

V100 Series

User Guide

Part No. 875-0174-000 Rev. B2

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

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Hemisphere GPS Precision GPS Applications

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6,111,549	6,397,147	6,469,663	6,501,346	6,539,303
6,549,091	6,631,916	6,711,501	6,744,404	6,865,465
6,876,920	7,142,956	7,162,348	7,277,792	7,292,185
7,292,186	7,373,231	7,429,952		

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Hemisphere GPS	Telephone number:	(403) 259-3311
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Hemisphere GPS
8444 N. 90th Street, Suite 130
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1: Introduction

Overview

Overview

Welcome to the V100/V110 GPS Compass User Guide and congratulations on purchasing this high-performance GPS compass. The V100 is based upon Hemisphere GPS' exclusive Crescent®-branded, application-specific integrated circuit (ASIC) computer chipset technology.

Note: The V100/V110 GPS Compass will be referred to as the V100.

The V100 is a complete GPS compass and positioning system in a single enclosure that requires only one power/data cable connection. The V100 is designed primarily for the marine market, however, it is also suitable for other markets, such as machine control and agriculture guidance. This user guide addresses the primary use of the V100 in the marine industry, however, the information provided is broad enough to satisfy the needs of the V100 use in other markets.

The V100 is an integrated system that houses the Crescent Vector OEM module, dual GPS antennas, DGPS beacon module and H-field beacon antenna (V110 version only), power supply, single axis gyro and a tilt sensor. The gyro and tilt sensor are present to improve system performance and to provide backup heading information in the event that a GPS heading is not available due to signal blockage.

Note: The V100 model is identical to the V110 with the exception that it does not contain a DGPS beacon module. If you purchased the V100, please ignore the sections of this manual that discuss the beacon signal, receiver operation and implications to installation relating to the beacon signal.

Crescent technology supports multiple RF front ends - enabling tighter coupling of measurements from separate antennas for use in heading-based products. Users will achieve excellent accuracy and stability, due to Crescent's more accurate code phase measurements, improved multipath mitigation and fewer components.

The GPS antennas inside the V100 are separated by 0.5 meters (0.55 yards) between antenna phase centers, resulting in a 0.50° RMS heading performance. The V100 provides heading updates of up to 20 Hz and positioning updates of up to 10 Hz. It delivers positioning accuracy of 60 centimeters (23.62 inches) and 0.50° RMS with 50 centimeter (19.69 inches) antenna separation (when using Differential GPS corrections from Space Based Augmentation Systems (SBAS)) or its optional internal SBX beacon demodulator.

The V100 also features Hemisphere GPS' exclusive COAST™ software that enables Hemisphere GPS' receivers to utilize old differential GPS correction data for 40 minutes or more without significantly affecting the quality of positioning. When using COAST, the Crescent Vector OEM is less likely to be affected by differential signal outages due to signal blockages, weak signals or interference.

If you are new to GPS and SBAS, we recommend that you consult Hemisphere GPS' GPS Technical Reference manual for further information on these services and technologies before proceeding.

2: Installation

Mounting Locations

Mounting Options

Powering the V100

Connecting the V100 to External Devices

Mounting Location

When considering mounting locations, you will need to give regard for both GPS (and hence SBAS) and beacon reception. The following two sections provide information that will help determine the best location for the V100.

GPS Reception

When considering various locations to mount the V100, consider the following recommendations closely.

- The V100 computes a position based upon the internal primary GPS antenna element. Mount the V100 in the location for which you desire a position with respect to the primary GPS antenna, which is located on the end opposite the recessed arrow on the underside of the enclosure.
- When choosing a location to mount the antenna, please ensure that there is a clear view of the sky available to the V100. This will ensure that GPS and SBAS satellites are not masked by obstructions, potentially reducing system performance.
- It is important to locate any transmitting antennas away from the V100 by at least a few feet. This will ensure that tracking performance is not compromised, giving you the best performance possible.
- Make sure that there is enough cable length to route into the vessel, in order to reach a breakout box or terminal strip.
- Do not locate the antenna where environmental conditions exceed those specified in Table B-6 in the appendix.

Beacon Reception

When using the V110's internal beacon receiver as the correction source, you will need to consider the possible mounting locations from a perspective of ambient noise within the beacon band. The following list provides some general guidelines for deciding upon a location with respect to maximizing beacon performance.

- Ensure that the antenna is as far as possible from all other equipment that emits Electromagnetic Interference (EMI), including DC motors, alternators, solenoids, radios, power cables, display units and other electronic devices.
- If you are installing the antenna on a vessel, mount the V110 as high as possible, considering maintenance and accessibility. In addition, ensure that the antenna is higher than the highest metal object on the vessel.
- If a radar system is present, mount the antenna outside the path of the radar beam.

The V110's internal beacon receiver calculates a Signal to Noise Ratio (SNR), measured in decibels (dB), that indicates the receiver's performance. The SNR is height of the signal above the noise floor. The higher the SNR, the better your beacon receiver is demodulating the signal. The optimum antenna location will be a position where your average SNR is highest. You should turn on all accessories that you intend to use during normal operation when locating the best position for the antenna. By monitoring the SNR, you can determine the optimum location with respect to beacon reception. The SNR is available in the $CRMSS NMEA message described in Hemisphere GPS' GPS Technical Reference manual.

V100 Environmental Considerations

The V100 is designed to withstand the harsh outdoor environment, however, there are specific environmental limits that should be met when storing and using this system.

The V100 is designed to be stored between -40°C and +85°C (-40°F and +185°F). The operating temperature is -30°C and +70°C (-22°F and +158°F). It is designed for harsh marine use and will operate in an environment with 100 % relative humidity.

Mounting Orientation

There are two primary mounting orientations possible with the V100 system. The first and most common method is to mount the V100 enclosure pointing in a direction parallel to the axis of the boat, facing the bow. This mounting configuration provides the ability for the V100 system to output both heading and the pitch of the vessel.

If a gyrocompass is present onboard, this could be used as truth to calibrate the physical heading of the V100 and its corresponding heading measurements to true heading of the boat by entering a heading bias into the V100 configuration. For example, if a gyrocompass heading provides 183.2° while the V100 provides a heading of 184.0°, a bias of -0.8 (the bias is added) should be programmed into the V100 to calibrate its heading. The V100 could be physically adjusted to correct for this deviation.

The second method of mounting the V100 system is to mount the V100 perpendicular to the boat's symmetrical axis. This orientation will provide the heading and roll of the vessel. The V100 is then configured with a heading bias of +90° or -90°, depending if the V100 points to port or starboard, to correct the heading.

A feature is present in the V100 to change the sign of the roll/pitch measurement to be positive or negative, depending on the required

conversion for positive/negative roll, if needed. Consult Hemisphere GPS' GPS Technical Reference manual for further information.

V100 Alignment

The top of the V100 enclosure incorporates a pair of sight design features for assisting antenna alignment. The sights will help you to align the enclosure with respect to an important feature on your vessel. (See Figure 1-1 on page 9 and Figure 1-2 on page 10.)

To use the sights, center the small post on the opposite side of the enclosure from you, within the channel made in the medallion located in the center of the enclosure top as shown in the two following figures. Alignment accuracy when looking through the long site is approximately +/- 1°. Using the short site alignment is approximately accurate to +/- 2.5°.

Figure 1-1. Lining up the alignment sight

Figure 1-2. Correctly lined-up alignment sight

If you have another accurate source of heading data on your vessel, such as a gyrocompass, you may use its data to correct for a bias in V100 alignment within the V100 software configuration. Alternatively, you may wish to physically adjust the heading of the V100 so that it renders the correct heading measurement, however, adding a software offset is an easier process.

Mounting Options

The V100 allows for two different mounting options:

- Fixed-base mounting
- Pole-and-rail mounting

Fixed-Base Mounting

The fixed base supplied with the V100 is intended to allow you to mount the system to a flat surface. This surface may be something that you fabricate for the sake of the installation, or may be something that already exists on your vessel or an off-the-shelf item, such as a radar mounting plate.

Figure 1-1 on page 9, shows the following features for the fixed base:

- Six holes for mounting onto the V100 enclosure
- Four slots used for fastening the mounted enclosure to the vessel
- Four tunnels that allow you to route the cable outside the base and along the mounting surface
- Two small keys that aid the alignment of the base to the enclosure
- Channel through the mount for the power/data cable

The slots on the bottom of the base allow for a degree of adjustment when the V100 is secured in its final location.

Note: You do not necessarily need to orient the antenna precisely as you can enter a software offset to accommodate for any bias in heading measurement due to installation.

The base has four tunnels that allow you to bring the power/data cable out from within the mount in order to route it along the surface of the plate beneath the V100 system. Alternatively, you may wish to route the power/data cable through the mounting surface rather than bringing it out through one of the tunnels. (See Figure 1-3 .)

Figure 1-3. Fixed mount base

Figure 1-4 provides a bottom view of the fixed mount base.

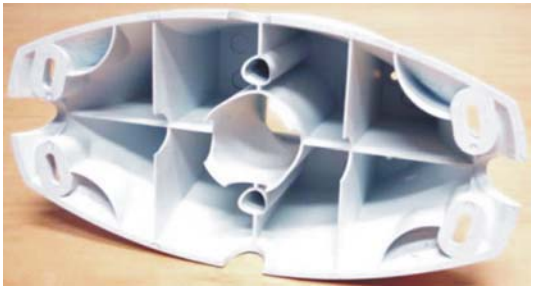

Figure 1-4. Bottom view of fixed mount base

Before mounting the antenna on the fixed base:

- Decide if you need the roll measurement. If you do, the V100 will need to be installed perpendicular to the vessel axis. If you do not require roll, install the V100 parallel with the vessel's axis (Figure 1-5).

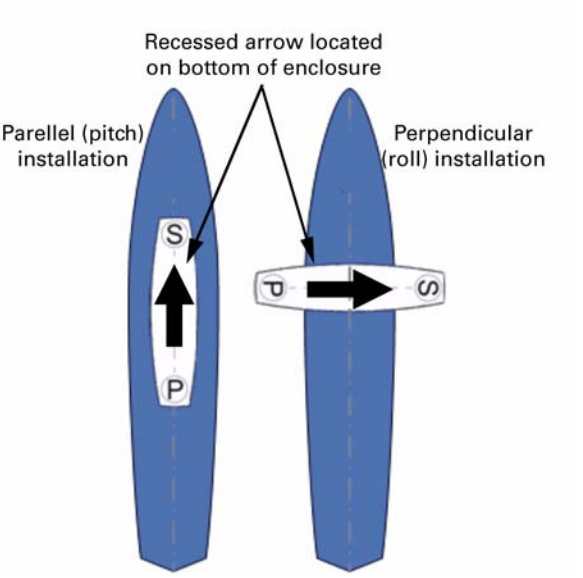

Figure 1-5. V100's parallel perpendicular installation

- Choose a location that meets the mounting location requirements.
- Using the fixed base as a template, mark and drill the mounting holes as necessary for the mounting surface.

Routing the cable - To install the V100 using the fixed base:

1. Insert either end of the power/data cable through the center of the fixed base. (See Figure 1-6 on page 14 and Figure 1-7 on page 14.)

Figure 1-6. Running cable through fixed base mount

Figure 1-7. Running cable through fixed base

2. Align the connector keyway of the cable to the key of the connector mounted on the V100 enclosure. (See Figure 1-8.)
3. Insert the cable mount connector into the bulkhead connector, aligning the locking ring at the same time. (See Figure 1-8 .)

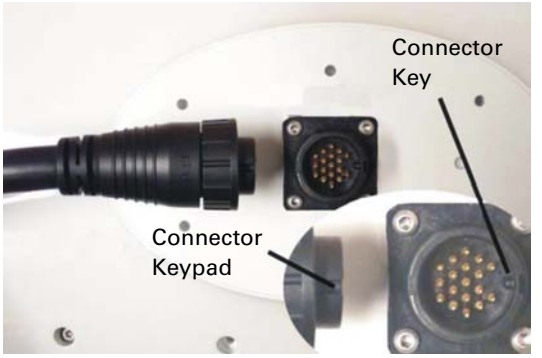

Figure 1-8. Power/Data cable and keyway

4. Once inserted, rotate the ring clockwise until it locks. The locking action is firm, but you will feel a positive “click” when it has locked. (See Figure 1-9 .)

Figure 1-9. Connecting the power/data connector to V100

5. Once you have secured the connector, slide the fixed base up to the bottom of the V100 enclosure. There are two alignment keys on top of the base that just fit into two holes of the V100 enclosure.
6. Once you have aligned the base, use a screwdriver fitted with the supplied Torx T20 bit to fasten the base to the enclosure using the supplied screws. These screws self tap a thread in the blind screw holes of the enclosure. Fasten the screws firmly, but be careful not to strip the thread.

Note: The base is not intended to be removed and re-fastened frequently. Frequent removal of the base from the enclosure may result in failure of the screw hole threads. Stripped threads are not covered under the product warranty.

Figure 1-10 and Figure 1-11 show the location of the screw holes.

Figure 1-10. Fastening the fixed base to the V100

Figure 1-11. Fastening the fixed base to the V100

7. Once you have fastened the fixed base to the V100 enclosure using six mounting screws, you are ready to fasten the assembly to your mounting surface. It is recommended to use machine screws that have an hexagonal Allen Key head and an "L-shaped" Allen Key, as there may not be sufficient clearance between the bottom of the antenna and your mounting surface to use a normal screwdriver.

Note: We do not supply the mounting surface hardware. You will need to supply the appropriate fastening hardware required to complete the installation of the V100 and mount assembly.

Pole and Rail Mount

Note: This pole and rail mount does not meet the IEC 60945, section 8.7 for vibration.

You may choose to pole-mount or rail-mount the V100 as opposed to the fixed base mounting approach. The pole mount incorporates a 1-14-UNS thread. To aid in the installation of the V100, we have supplied a hex jam nut and washer. These are used to secure the antenna in a particular direction without bottoming out the system on the threaded pole. Additionally, the nut and washer distributes forces associated with vibration onto the bottom surface of the V100 pole mount.

Warning!

Do not bottom out the V100 pole base on the threaded mount. Such manner can damage the system. Use of the jam nut and washer are mandatory for pole mounting. Any damage resulting from not using these pieces to mount the V100 will not be covered under warranty.

Before mounting the antenna or the pole mount bracket: -

- Decide if you need the roll measurement. If you need roll measurement, the V100 will need to be installed perpendicular to the vessel axis. If it you do not need roll measurement, install the V100 parallel with the vessel's axis.
- Choose a location that meets the mounting location requirements.
- Mark and drill the mounting holes as necessary for the threaded pole.
- Alternatively, you may rail mount the V100 with appropriate hardware.

Pole mount installation and preparation - You will need to supply the pole or rail mount hardware that you wish to use. To install the pole mount:

1. Once you have installed the pole or rail mount, thread the hexagonal jam nut onto the mount, followed by the stainless steel washer (both are supplied with the V100 system).
2. Thread the nut onto the nut approximately 8 to 10 full turns to provide adequate mounting thread for the pole mount base. (See Figure 1-12 .)

Figure 1-12. Threading on the lock nut and washer

Routing the cable: -

1. When mounting the V100 using the pole mount, the cable must first be run through the center of the pole mount base from top to bottom, through the pole, then through any bulkheads as needed. (The power/data connector is too large to fit through the threaded portion of the pole mount base.) (See Figure 1-13 on page 20 through Figure 1-15 on page 21)

Note: Be sure to have some slack to move the cable in and out of the pole mount by a few inches (centimeters). This will allow you to connect the cable to the V100 easily.

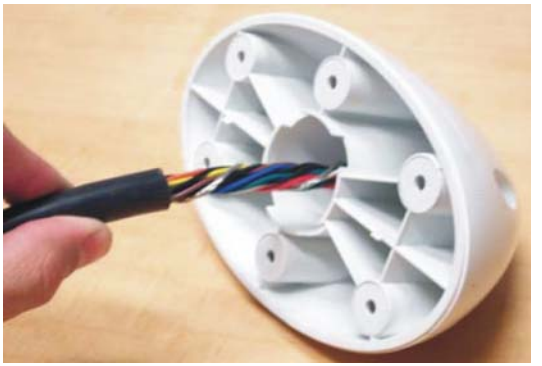

Figure 1-13. Running cable through the pole base

Figure 1-14. Running cable through the pole base

Figure 1-15. Running cable through the pole base

Once you have routed the cable correctly through the pole mount base and the mounting pole, the mounting assembly should look like Figure 1-16.

Figure 1-16. Completed cable run

Mounting to pole mount thread - 1.

1. Thread the pole mount base onto the pole mount four to five full turns. (See Figure 1-17)

Figure 1-17. Threading the pole base onto the mount

2. Ensure that there is a gap between the lock nut, washer and pole mount base. This will allow you to orient the combination of the V100 and pole mount base to the vessel.(See Figure 1-18 .)

Figure 1-18. Pole base threaded onto mount

To connect the cable to the V100:

1. Fasten the cable to the V100 connector. The connector on the receiver enclosure has a key and the cable-mount connector has a keyway. The key and keyway need to align as you insert the cable-mount connector into the bulkhead connector.

Note: The locking ring on the cable-mount connector may need to be aligned as it is inserted into the bulkhead connector to ensure that it seats properly.

2. Once the cable-mount connector is fully seated, rotate the locking ring clockwise until it locks once the cable-mount connector is seated fully. You will feel the ring “click” when it is locked. (See Figure 1-19 and Figure 1-20.)

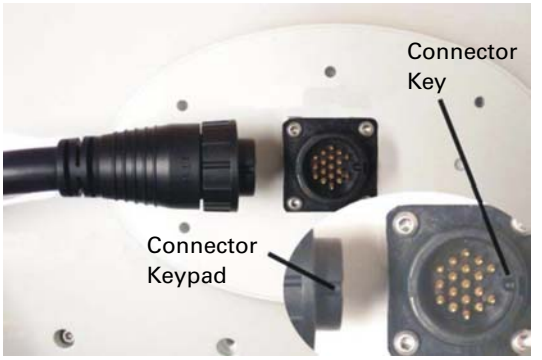

Figure 1-19. Power/data cable key and keyway

Figure 1-20. Connected power/data cable

Fastening the V100 to the pole mount base - To fasten the V100 to the pole mount base with the supplied self-taping screws:

1. Fasten the V100 enclosure to the pole mount base using the supplied self-tapping screws.
2. Align the two alignment keys on top of the base to the two holes on the V100 enclosure.
3. Use a screwdriver fitted with the supplied Torx T20 bit to fasten the base to the enclosure using the supplied screws. These screws self tap a thread in the blind screw holes of the enclosure. Fasten the screws firmly, but be careful not to strip the thread. (See Figure 1-21)

Note: The base is not intended to be removed and re-fastened frequently. Frequent removal of the base from the enclosure may result in failure of the screw hole threads. Stripped threads are not covered under the product warranty.

Figure 1-21. Fastening the pole base to the V100

4. Rotate the hex nut and washer up to the bottom of the surface of the pole mount base. Do not tighten them at this point as you will need to align the V100. (See Figure 1-22 .)

Figure 1-22. Threading the lock nut against the pole base

5. Orient the V100 using the sights on the top of the enclosure.
6. Use an adjustable wrench to tighten the lock nut against the V100 while ensuring accurate alignment of the antenna system. (See Figure 1-23 .)

Figure 1-23. Locking the V100 once aligned

Note: The locking nut will need to be tightened against the pole mount base tightly. To ensure that the locking nut is not over-tightened, periodically check to see how secure the antenna system is, as mounted on the pole. If it is loose, tighten the lock nut further until you can not move it.

Routing and securing the power/data cable

The V100 comes with a 15 meter (16.40 yards) power/data cable (optional 30 meter (32.80 yards) power/data cable available). When choosing a route for the antenna extension cable:

- Avoid running the cable in areas of excessive heat
- Keep the cable away from corrosive chemicals
- Do not run the cable through door or window jams
- Keep the cable away from rotating machinery
- Do not bend excessively or crimp the cable
- Secure along the cable route using plastic tie wraps as necessary

Warning!

Improperly installed cables near machinery can be dangerous.

Powering the V100

Power Considerations

The V100 is powered with an input voltage between 10 and 36 VDC. For best performance, the supplied power should be continuous and clean. Table 2-1 provides the power specifications of the V100.

Table 2-1: Power requirements

Input Voltage	Input current	Input power
10 to 36 VDC	<370 mA @ 12 VDC	<5 W maximum

The V100 power supply features reverse polarity protection but will not operate with reverse polarity.

Connecting to a Power Source

The first step to powering the V100 is to terminate the wires of the power cable as required. There are a variety of power connectors and terminals on the market from which to choose, depending on your specific requirements.

Warning!

Do not apply a voltage higher than 36 VDC. This will damage the receiver and void the warranty.

To interface the V100 power cable to the power source:

- Connect the red wire of the cable's power input to DC positive (+)
- Connect the black wire of the cable's power input to DC negative (-)

Once the V100 system has been installed, you are ready to turn the system on by applying power to it. The V100 smart antenna will start when an acceptable voltage is applied to the power leads of the extension cable. Be careful not to provide a voltage higher than the input range as this will damage the receiver.

Electrical Isolation

The V100 features a power supply that is isolated from the communication lines. Further, the PC-ABS plastic enclosure isolates the electronics mechanically from the vessel. This addresses the issue of vessel hull electrolysis.

Connecting the V100 to External Devices

Interfacing the V100

The V100 uses a single cable for application of power and to facilitate the input and output operations. The cable is 15 meters (16.4 yards) in length and is terminated on the receiver end with an environmentally sealed 18-pin connection. The opposite end is un-terminated and requires field stripping and tinning.

Depending on the application and installation needs, this cable may need to be shortened. If so, this is a simple matter.

However, if you require a longer cable run than 15 meters (16.4 yards), you may purchase a 30 meters (32.8 yards) cable through your equipment dealer, or alternatively, bring the cable into a break-out box that incorporates terminal strips, within the vessel. To lengthen the serial lines inside the vessel, ensure that you use 20-gauge twisted pairs and minimize the additional wire length. The RS-422 signal should be used for longer cable runs as compared to the RS-232 ports, as it is more resistant to noise and attenuation.

When lengthening the power input leads to the V100, please ensure that the additional voltage drop is small enough that your power system can continue to power the system above the minimum voltage of the system. Wire of 18-gauge or larger should also be used.

Power/Data Cable Pin-Out

Figure 1-24 on page 32 and Figure 1-25 on page 33 show the Cable, IO-X, CIRC(F) 18-PT, 15 M or 30 M Wiring cable.

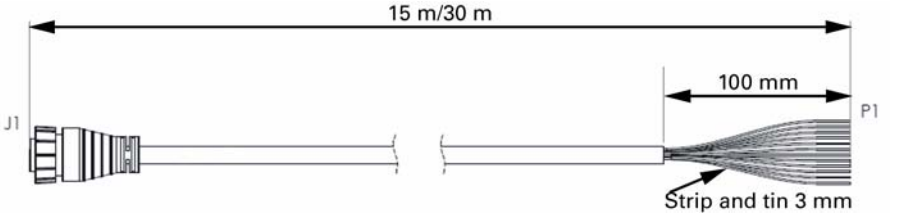

Figure 1-24. Cable, IO-X, CIRC(F) 18-PT, 30M

Table 2-2 provides the Cable, IO-X, CIRC(F) 18-PT, 15 M or 30 M Wiring.

Table 2-2: Cable, IO-X, CIRC(F) 18-PT, 15M or 30M wiring

Pair	Color code	AWG	J1	Function
	Bare		10	RF SHIELDED DRAIN
1	BLK RED	18 18	2 1	Power GRND Power input
2	BLK with BLU stripe BLU	24 24	4 3	RS-232, port A RX RS-232, port A TX
3	GRY	24	12	Sig GRND
4	BLK with GRN stripe GRN	24 24	11 6	RS-422-, port A RS-422+, port A
5	BLK with BRN stripe BRN	24 24	8 7	RS-232, port B RX RS-232, port B TX
6	YEL with BLK stripe YEL	24 24	15 16	RS-422-, port B RS-422+, port B
7	WHT with RED stripe WHT	24 24	14 13	Alarm Alarm

Note: PPS is supported on pins 17 and 18 on the V100/V110, but not connected in the standard cables.

Figure 1-25. Cable, IO-X, CIRC(F) 18-PT, 30M rear view

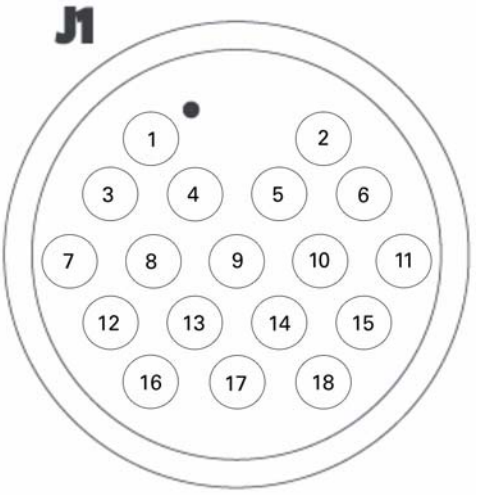

Table 2-3 on page 33 provides cable, IO-X, CIRC(F) 18-PT, 15 m or 30m cable connector pin out.

Table 2-3: Cable, IO-X, CIRC(F) 18-PT, 15 m or 30M pin out

Pin number	Signal Name	Wire color	Wire Gauge
1	Power input +	RED	18 AWG
2	Power input -	BLK	18 AWG
3	Port A TX RS232	BLU	24 AWG
4	Port A RX RS232	BLK with BLU stripe	24 AWG
5	Not connected		

Table 2-3: Cable, IO-X, CIRC(F) 18-PT, 15 m or 30M pin out

Pin number	Signal Name	Wire color	Wire Gauge
6	Port A RS422 +	GRN	24 AWG
7	Port B TX RS232	BRN	24 AWG
8	Port B RX RS232	BLK with BRN stripe	24 AWG
9	Not connected		
10	RF shield drain	Bare	24 AWG
11	Port A RS422 -	BLK with GRN stripe	24 AWG
12	Signal ground	GRY	24 AWG
13	Alarm 1	WHT	24 AWG
14	Alarm 2	WHT with RED stripe	24 AWG
15	Port B RS422+	YLW with BLK stripe	24 AWG
16	Port B RS422-	YLW	24 AWG
17	1PPS +		
18	1PPS -		

Serial Port Interface

The V100 offers position and heading data via both RS-232 and RS-422 level serial ports. The answer of which serial port level to use resides with the serial port level(s) supported by the other electronics involved. You may find that the other electronics need either serial port level or a mixture of both.

The following sections describe the two serial port levels supported by the V100.

RS-232 Interface Level

The V100 features two full duplex (bi-directional) RS-232 serial ports. In addition to outputting data, these ports are used for firmware upgrades.

Data output from both RS-232 Ports A and B are also output on the RS-422 ports.

RS-422 Interface Level

The RS-422 standard allows for one device to communicate with many other devices simultaneously, therefore the RS-422 ports are only talkers. These ports are in accordance with international marine standard IEC 61162. See Annex C of the standard for a description.

Serial Port Configuration

You may configure Port A or B of the GPS receiver to output any combination of data that you wish. Port A can have a different configuration from Port B in terms of data message output, data rates, and the baud rate of the port. This allows you to configure the ports independently, based upon your needs. For instance, if you wish to have one generalized port and one heading-only port, you may wish to configure Port A to have GGA, VTG, GSV, ZDA and HDT all output at 1 Hz over a 9600 baud rate. You may also wish to configure Port B for HDT and ROT message output at their maximum rate of 20 Hz over a 19,200 baud rate.

The messages that you configure each port to output, and the rate of the port will be the same for both RS-232 and RS-422 interface levels. For instance, the RS-232 Port A and RS-422 Port A output the same data messages at the same baud rate. If the baud rate or messages for the RS-422 port need to be changed, this needs to be commanded through the RS-232 port.

Both RS-232 and RS-422 output signals may be used simultaneously.

Interfacing to a PC

PC computers typically use a DB9-male connector for RS-232 serial port communications. To terminate either port for connection to a PC serial port, connect the wires to a DB9 female connector according to Table 2-4 andTable 2-5 on page 37).

Table 2-4: Port A DB9 RS-232 interface configuration

Pin	Wire Color	Signal
2	Blue	Port A transmit RS-232
3	Black/blue striped	Port A receive RS-232
5	Grey	Signal ground

Table 2-5: Port B DB9 RS-232 interface configuration

Pin	Wire Color	Signal
2	Brown	Port B transmit RS-232
3	Black/brown striped	Port B receive RS-232
5	Grey	Signal ground

Figure 1-26 displays the numbering scheme for a DB9 socket connector (female). The associated numbering for the plug connector (male) on a PC computer is a mirror reflection of scheme showed in this figure.

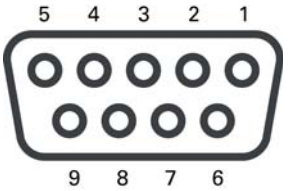

Figure 1-26. DB9 female socket numbering

Note: For successful communications, the baud rate of the V100 serial ports must be set to match that of the devices to which they are connected.

When interfacing to other devices, make sure that the transmit data output from the V100 is connected to the data input of the other device. The signal grounds must also be connected.

Since RS-422 is a balanced signal with positive and negative signals referenced to ground, ensure that you maintain the correct polarity. For instance, when connecting the transmit data output positive signal to the receive line of the other device, it should be connected to the receive positive terminal. The negative transmit data signal from the

V100 is then connected to the receive data negative input of the other device.

There is likely not much reason to connect the receive data input of the V100 to another device unless it is able to send configuration commands to the V100. Since the V100 uses proprietary NMEA 0183 commands for control over its configuration, the vast majority of electronics will not be able to configure its settings unless the other device has a terminal setting where you can manually issue commands.

Default Parameters

This section outlines the default parameters of the V100. Table 2-6 on page 38 through Table 2-11 on page 42, provide details on the firmware types, port settings, default NMEA messages, elevation mask, differential age mask, default differential mode and beacon receiver settings.

Note: Any changes you make to the V100 configuration need to be saved with the $JSAVE command in order to be present for a subsequent power-cycle.

Table 2-6: Default port settings

Port	Baud rate	NMEA messages	Default update rate	Wires
Port A (RS-232)	19200	GPGGA, GPVTG, GPGSV, GPZDA, GPHDT, GPROT	1 Hz	Blue BLK with BLU
Port B (RS-232)	19200	GPGGA, GPVTG, GPGSV, GPZDA, GPHDT, GPROT	1 Hz	BRN BLK with BRN

Table 2-6: Default port settings

Port	Baud rate	NMEA messages	Default update rate	Wires
Port A (RS-422) output only	19200	GPGGA, GPVTG, GPGSV, GPZDA, GPHDT, GPROT	1 Hz	GRN BLK with GRN
Port B (RS-422) output only	19200	GPGGA, GPVTG, GPGSV, GPZDA, GPHDT, GPROT	1 Hz	YLW BLK with YLW
Power		10-36 V		RED (+) BLK (-)

Note: 1 Hz is the default update rate for NMEA messages. 10 Hz is the standard maximum rate, but a subscription can be purchased to upgrade the output rate to 20 Hz. Note that NMEA GPGST, GPGSA, GPGSV and GPRRE are restricted to 1 Hz in all cases.

Table 2-7: IEC approved sentences

Sentence	Description	Output rate
GPDTM	Datum reference	0 - 10 Hz
GPGBS	GNSS satellite fault detection	0 - 10 Hz
GPGGA	GPS fix data	0 - 10 Hz
GPGNS	GNSS fix data	0 - 10 Hz
GPRMC	Recommended minimum specific GNSS data	0 - 10 Hz
GPVTG	Course over ground and ground speed	0 - 10 Hz

Table 2-7: IEC approved sentences

Sentence	Description	Output rate
GPZDA	Time and date	0 - 10 Hz
GPGRS	GNSS range residuals	0 - 10 Hz
GPGSA	GNSS DOP and active satellites	0 - 1 Hz
GPGST	GNSS pseudorange error statistics	0 - 1 Hz
GPGSV	GNSS satellites in view	0 - 1 Hz
GPGLL	Geographic position - (latitude/longitude)	0 - 10 Hz
GPRRE	Range residual message	0 - 10 Hz
GPHDG	Command to provide magnetic deviation and variation for calculating magnetic or true heading	0 - 10 Hz
GPHDT	Command to provide true heading of the vessel	0 - 20 Hz
GPROT	Command that contains the vessel's rate of turn information	0 - 10 Hz

Note: GRS, GSA, GST and GSV support external integrity checking. They are to be synchronized with corresponding fix data (GGA or GNS).

Note: The data bits, parity and stop bit are not adjustable. They are fixed with an 8-n-1 configuration.

Table 2-8: Other sentences

Sentence	Description
$GPHDM	Magnetic heading (based on RTK-derived GPS and magnetic declination)
$J4STRING	Output GPGGA, GPVTG, GPGSA and GPZDA (1Hz max)
$PCSI,1	Beacon status
$PSAT,HPR	Proprietary NMEA sentence that provides the heading, pitch/roll information and time in a single message
$PSAT,INTLT	Proprietary NMEA sentence that provides the title measurement from the internal inclinometer, in degrees

Table 2-9: Available baud rates

Baud Rates
4800
9600
19200
38400

Table 2-10: Correction age and elevation mask defaults

Max DGPS age	Elevation mask
2700 seconds	5°

Table 2-11: Default differential mode

V100 differential mode	V110 differential mode
SBAS (WAAS/EGNOS)	Beacon

The internal beacon module operates in full automatic mode by default as shown in the Table 2-12 .

Table 2-12: Frequency selection

Frequency Selection	MSK rate selection
Automatic	Automatic

3: V100 Operation

GPS Overview

Understanding the V100

GPS Overview

For your convenience, both the GPS and SBAS operation of the V100 features automatic operational algorithms. When powered for the first time, the V100 system will perform a “cold start,” which involves acquiring the available GPS satellites in view and the SBAS differential service.

If SBAS is not available in your area, an external source of RTCM SC-104 differential corrections may be used. If you choose to use an external source of correction data, you will need to ensure that the external source supports an eight data bit, no parity and one stop bit configuration (8-N-1).

GPS Operation

The GPS engine is always operating, regardless of the DGPS mode of operation. The following sections describe the general operation of the V100’s internal GPS engine.

Note: Differential source and status have no impact on heading. They only have an impact on positioning.

Automatic Tracking - The GPS engine within the V100 automatically searches for GPS satellites, acquires the signals and manages the navigation information required for positioning and tracking. This is a hands-free mode of operation.

Receiver Performance - The V100 works by finding four or more GPS satellites in the visible sky and uses the information those satellites provide to compute an appropriate position (within 5 meters (5.47 yards)). Since there is some error in the GPS data calculations, the V100 also tracks a differential correction. The V100 uses these corrections to improve its position to less than 1 meter (1.09 yards). The V100 has an

accuracy of 2.5 meters (2.7 yards) with no differential and 60 centimeters (23.6 inches) with differential.

There are two main aspects of GPS receiver performance:

- Positioning
- Satellite acquisition quality

When the V100 is properly positioned the satellites transmit coded information to the antenna on a specific frequency that allows the receiver to calculate a range to each satellite. GPS is essentially a timing system. The ranges are calculated by timing how long it takes for the GPS signal to reach the GPS antenna. To calculate the geographic location, the GPS receiver uses a complex algorithm incorporating satellite locations and ranges to each satellite. Reception of any four or more of these signals allows a GPS receiver to compute 3-dimensional coordinates.

Differential Operation

The purpose of differential GPS (DGPS) is to remove the effects of SA, atmospheric errors, timing errors and satellite orbit errors, while enhancing system integrity. Autonomous positioning capabilities of the V100 will result in positioning accuracies of 2.5 meters (2.73 yards) (95%). In order to improve positioning quality to sub-meter levels the V100 is able to use differential corrections received through the internal SBAS demodulator. In addition to these differential services the V110 can also receive radiobeacon corrections.

For more information on the differential services and the associated commands, please refer to Hemisphere GPS' GPS Technical Reference manual.

Automatic SBAS (WAAS, EGNOS, MSAS and others)
Tracking - The V100 will automatically scan and track SBAS signals without the need to tune the receiver. The V100 features two-channel tracking that provides an enhanced ability to maintain a lock on a SBAS satellite when more than one satellite is in view. This redundant tracking approach results in more consistent tracking of a SBAS signal when in an area where signal blockage of a satellite is possible.

Beacon Operation - Many marine authorities, such as coast guards, have installed networks of radiobeacons that broadcast DGPS corrections to users of this system. With the increasing utility of these networks for terrestrial applications, there is an increasing trend towards densification of these networks inland. The dual channel beacon receiver in the V110 is able to operate in manual or automatic tuning mode, or using database mode will select the closest station in compliance with IEC 61108-4 standards.

e-Dif - Extended differential (e-Dif) is an optional mode in which the receiver can perform with differential-like accuracy for extended periods without the expense or uncertainty of an external differential service. It models the effects of ionosphere, troposphere, and timing errors for extended periods by computing its own set of pseudo-corrections. e-Dif may be used anywhere geographically and is especially useful where SBAS networks have not yet been installed, such as South America, Africa, Australia and Asia.

The positioning performance of the receiver unit is dependent upon the rate at which the environmental modeling of e-Dif and the environmental errors diverge. The more that e-Dif is able to model the errors correctly, the longer that e-Dif will provide reliable, accurate positioning. The accuracy of positioning will have a slow drift that limits use of e-Dif to approximately 30 to 40 minutes, however, it depends on how tolerable your application is to drift, as e-Dif can be used for longer periods. Our testing has shown that accuracy will often be better than 1 meter (1.09 yards) virtually 95% of the time after 30 minutes of e-Dif operation.

Understanding the V100

The purpose of the V100 is to provide accurate, reliable heading and position information at high update rates. To accomplish this task, the V100 uses a high performance GPS engine and two multipath-resistant antennas for GPS signal processing. One antenna is designated as the Primary GPS, while the other is designated as the Secondary GPS. Positions computed by the V100 are referenced to the phase center of the Primary GPS antenna. Heading data references the vector formed from the Primary GPS antenna phase center to the Secondary GPS antenna phase center.

There is a heading arrow located on the bottom of the V100 enclosure, which defines system orientation. The arrow points in the direction that the heading measurement is computed (when the antenna is installed parallel to the fore-aft line of the vessel). The secondary antenna is directly above the arrow.

Moving Base Station RTK

The V100's internal GPS engines use both the L1 GPS C/A code and carrier phase data to compute the location of the Secondary GPS antenna in relation to the Primary GPS antenna with a very high sub centimeter level of precision. The technique of computing the location of the Secondary GPS antenna with respect to the Primary antenna, when the Primary antenna is moving, is often referred to as moving base station Real-Time Kinematic (or moving base station RTK).

RTK technology generally is very sophisticated and requires a significant number of possible solutions to be analyzed where various combinations of integer numbers of L1 wavelengths to each satellite intersect within a certain search volume. The integer number of wavelengths is often referred to as the Ambiguity as they are initially ambiguous at the start of the RTK solution.

The V100 places a constraint on the RTK solution with the prior knowledge of the fact that the Secondary GPS antenna has a fixed

separation of 0.50 meters (1.64 feet) from the Primary GPS antenna inside the enclosure. This defines the search volume of the Secondary antenna as the surface of a sphere with radius 0.50 meters (1.64 feet) centered on the location of the Primary antenna. (Figure 3-1 on page 48)

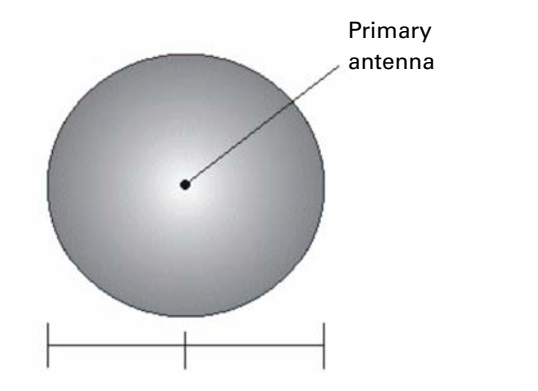

Figure 3-1. Secondary antenna's search volume

Note: The V100 moving base station algorithm only uses GPS to calculate heading. Differential corrections are not used in this calculation and will not affect heading accuracy.

Supplemental Sensors

Integrated inside the V100 are a tilt sensor and gyro, which are enabled by default. Each supplemental sensor may be turned on or off individually, however, the full functionality of the V100 system is realized only when all are used. Each supplemental sensor is inside the V100 enclosure, mounted on the internal printed circuit board.

Both sensors act to reduce the RTK search volume which improves heading startup and reacquisition times, and also has the benefit of improving the reliability and accuracy of selecting the correct heading solution by eliminating other possible, erroneous solutions.

Hemisphere GPS' GPS Technical Reference manual describes the commands and methodology required to recalibrate, query or change the status of these sensors.

Tilt Aiding

The V100's internal tilt sensor (accelerometer) is enabled by default, is factory calibrated, and constrains the RTK heading solution beyond the volume associated with just a fixed antenna separation, since the V100 knows the approximate inclination of the secondary antenna with respect to the primary. The search space defined by the tilt sensor will be reduced to a horizontal ring on the surface of the sphere. By reducing the search volume this considerably decreases startup and reacquisition times. (See Figure 3-2 .)

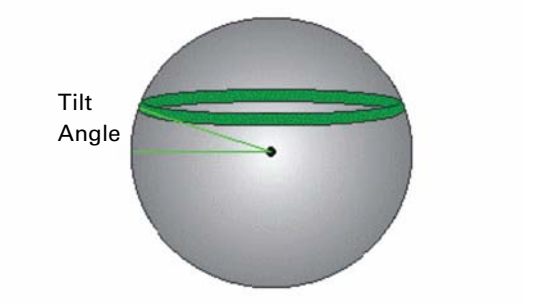

Figure 3-2. V100's tilt aiding

Gyro Aiding

The V100's internal gyro offers several benefits. It will shorten reacquisition times when a GPS heading is lost due to obstruction of satellite signals, by reducing the search volume required for solution of the RTK. The gyro provides a relative change in angle since the last

computed heading, and when used in conjunction with the tilt sensor defines the search space as a wedge-shaped location. (See Figure 3-3 .)

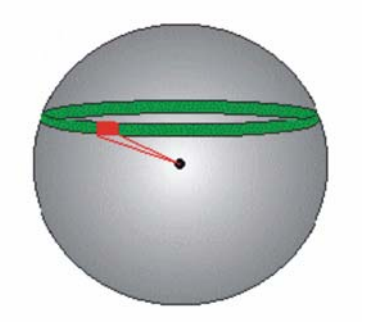

Figure 3-3. V100's gyro aiding

The gyro aiding accurately smooths the heading output and the rate of turn. It will also provide an accurate substitute heading for a short period (depending on the roll and pitch of the vessel) ideally seeing the system through to reacquisition. The gyro will provide an alternate source of heading accurate to within 1° for up to 3 minutes in times of GPS loss for either antenna. If the outage lasts longer than three minutes, the gyro will be deemed to have drifted too far and the V100 will begin outputting null fields in the heading output messages. There is no user control over the time-out period of the gyro.

The gyro will initialize itself at power-up and during initialization, or can be calibrated by the user as outlined in Hemisphere GPS' GPS Technical Reference manual. When the gyro is first initializing, it is important that the dynamics that the gyro experiences during this warm-up period are similar to the regular operating dynamics. For example, if you will be using the V100 on a high speed, maneuverable craft, it is essential that when gyro aiding in the V100 is first turned on and is used in an environment that has high dynamics for the first 5 to 10 minutes instead of sitting stationary.

With the Gyro enabled, the gyro is also used to update the post HTAU smoothed heading output from the moving base station RTK GPS

heading computation. This means that if the value of HTAU is increased while the gyroid is enabled, there will be little to no lag in heading output due to vehicle maneuvers. Hemisphere GPS' GPS Technical Reference includes information on setting an appropriate HTAU value for your application.

Time Constants

The V100 incorporates user-configurable time constants that can provide a degree of smoothing to the heading, course over ground, and speed measurements. Depending on the expected dynamics of the vessel, you may wish to adjust these parameters. For instance, if the vessel is very large and is not able to turn quickly or would not pitch quickly, increasing this time is reasonable. The resulting values would have reduced "noise," resulting in consistent values with time. However, artificially increasing this value such that it does not agree with a more dynamic vessel could create a lag in measurements. Formulas for determining the level of smoothing are located in Hemisphere GPS' GPS Technical Reference manual. If you are unsure on how to set this value, it is best to be conservative and leave it at the default setting.

The heading time constant allows you to adjust the level of responsiveness of the true heading measurement provided in the $HEHDT message. The default value of this constant is 2.0 seconds of smoothing when the gyro is enabled. The gyro by default is enabled, but can be turned off. By turning the gyro off, the equivalent default value of the heading time constant would be 0.5 seconds of smoothing. This is not done automatically, and therefore must be entered manually by the user. Increasing the time constant will increase the level of heading smoothing and increase lag.

The pitch time constant allows you to adjust the level of responsiveness of the pitch measurement provided in the $PSAT,HPR message. The default value of this constant is 0.5 seconds of smoothing. Increasing the time constant will increase the level of pitch smoothing and increase lag.

The heading rate time constant allows you to adjust the level of responsiveness of the rate of heading change measurement provided in the $HEROT message. The default value of this constant is 2.0 seconds of smoothing. Increasing the time constant will increase the level of heading smoothing.

The course over ground (COG) time constant allows you to adjust the level of responsiveness of the COG measurement provided in the $GPVTG message. The default value of this constant is 0.0 seconds of smoothing. Increasing the time constant will increase the level of COG smoothing. COG is computed using the primary GPS engine only, and its accuracy is dependant upon the speed of the vessel (noise is proportional to 1/speed) and when stationary, this value is invalid.

The speed time constant allows you to adjust the level of responsiveness of the speed measurement provided in the $GPVTG message. The default value of this parameter is 0.0 seconds of smoothing. Increasing the time constant will increase the level of speed measurement smoothing.

Alarm Functionality

A relay is located on the Type Heading Device (THD) circuit board. The relay contacts are isolated from all circuitry in the THD. The THD is connected to the coil side of the relay, but not to the contacts that are connected to the external pins through the main IO connector. If the THD loses power or heading, the coil voltage is lost and the relay opens and activates the notification method employed by the user. When the heading is valid, the relay contacts remain closed, completing the circuit as an indication that the V100 is operational.

Alarm Signal

There are two wires (24 AWG multistrands) on the output cable that are used for the external alarm function. The color codes for the two wires are white and white/red stripe and are the output of a relay. When this relay closes, the connection is complete on the user defined external notification device.

Watchdog

The watchdog is a timer that is controlled by the software which monitors if the heading is lost. The watchdog software is in compliance with IEC 60495.

Common Commands and Messages

Table 3-1 on page 54 through Table 3-7 on page 57 provide the common commands and brief description of what they do. Refer to Hemisphere GPS' GPS Technical Reference for more details.

Note: The messages have a default update rate of up to 10 Hz. The GPGSA, GPGST, GPGSV and GPRRE messages are only output at 1 Hz.

Table 3-1: Applications

Command	Description
$JAPP	Primary application 1

Table 3-2: Differential commands

Command	Description
$JDIFF	Differential mode
$JLIMIT	DGPS LIMIT distance
$JAGE	Max DGPS (COAST™) age (6 to 8100 seconds)
$JWAASPRN	Configure for specific SBAS PRN numbers
$JGEO	Query WAAS for current location and WAAS satellites
$JASC,D1	Request SBAS diagnostic information
$GPMSK	Tune beacon to specific frequency

Table 3-3: Serial port setting commands

Command	Description
$JBAUD	RS-232C, RS-422 (output) communication rate

Table 3-4: NMEA messages status and update rate

Command	Description
$GPGGA	GPS fix data
$GPGLL	Geographic position - lat/long
$GPGSA	GNSS DOP and active satellites
$GPGST	GNSS pseudo range error statistics
$GPGSV	GMSS satellites in view
$GPRMC	Recommended minimum specific GNSS data
$GPRRE	Range residual message
$GPVTG	COG and ground speed
$GPZDA	Time and date
$GPGBS	Satellite fault detection used for RTCM
$GPGNS	GNSS fix data
$GPGRS	GNSS range residual
$PCSI,1	Beacon status
$GPHDG	Provides magnetic deviation and variation for calculating magnetic or true heading
$GPHDT	RTK-derived GPS heading
$GPROT	RTK-derived GPS Rate Of Turn
$PSAT,HPR	Heading, pitch/roll and time in single message
$GPHDM	Magnetic heading (based on RTK-derived GPS and magnetic declination)
$J4STRING	Output GPGGA, GPVTG, GPGSA AND GPZDA (1 Hz MAX)

Note: The GP of the message is the talker ID.

Note: The GPRRE and $GPHDM commands do not comply with the current IEC 61162 standard.

Table 3-5: Heading parameters

Command	Description
$JATT,TILTAID	Enable/disable accelerometer, pre-calibrated
$JATT,TILTCAL	Calibrate accelerometer
$JATT,GYROAID	Enable/disable gyro
$JATT,LEVEL	Enable/disable level operation
$JATT,HTAU	Set/query heading time constant (0.0 to 3600.0 seconds)
$JATT,PTAU	Set/query pitch time constant (0.0 to 3600.0 seconds)
$JATT,HRTAU	Set/query time constant (0.0 to 3600.0 seconds)
$JATT,COGTAU	Set/query COG time constant (0.0 to 3600.0 seconds)
$JATT,SPDTAU	Set/query speed time constant (0.0 to 3600.0 seconds)
$JATT,HBIAS	Set/query heading bias (-180.0 to 180.0 degrees)
$JATT,PBIAS	Set/query pitch/roll bias (-15.0 to 15.0 degrees)
$JATT,NEGTILT	Enable/disable negative tilt
$JATT,ROLL	Configure for roll or pitch output
$JATT,NMEAHE	Changed the HDT and ROT, HDM and HDG message headers between GP and HE (and HC)

Table 3-6: General commands

Command	Description
$JATT,CSEP	Query antenna separation
$JAATT,MSEP	Manually set/query antenna separation
$JASC,Dx	Turn on/off diagnostics message x
$JQUERY,GUIDE	Query accuracy acceptableness
$JRESET	Reset unit's configuration to firmware defaults
$JSAVE	Save session's configuration changes
$JSHOW	Shows current configuration
$JOFF	Turn off all data messages
$JT	Query receiver type
$JI	Query unit's serial number and firmware versions
$JATT,SEARCH	Force a new RTK heading search
$JATT,SUMMARY	Show current TAU configuration

Table 3-7: Binary messages

Message	Description
$JBIN1	GPS position
$JBIN2	GPS DOP's
$JBIN80	SBAS
$JBIN93	WAAS ephemeris data
$JBIN94	Ionosphere and UTC conversion parameters
$JBIN95	Ephemeris
$JBIN96	Code and carrier phase

Table 3-7: Binary messages

Message	Description
$JBIN97	Process statistics
$JBIN98	Satellite and almanac
$JBIN99	GPS diagnostics

Appendix A: Troubleshooting

A: Troubleshooting

Table A-1 provides troubleshooting for common problems.

Table A-1: Troubleshooting

Symptom	Possible Solution
Receiver fails to power	• Verify polarity of power leads • Check integrity of power cable connectors • Check power input voltage (10 to 36 VDC) • Check current restrictions imposed by power source (minimum available should be > 1.0 A)
No data from V100	• Check receiver power status to ensure that the receiver is powered (an ammeter can be used for this) • Verify that desired messages are activated (this can be done through PocketMAX or with $JSHOW in any terminal program) • Ensure that the baud rate of the V100 matches that of the receiving device • Check integrity and connectivity of power and data cable connections

Table A-1: Troubleshooting

Symptom	Possible Solution
Random data from V100	• Verify that the RTCM or binary messages are not being output accidentally (send a $JSHOW command) • Verify baud rate settings of V100 and remote device match correctly • Potentially, the volume of data requested to be output by the V100 could be higher than the current baud rate supports. Try using 19,200 as the baud rate for all devices or reduce the amount of data being output
No GPS lock	• Verify V100 has a clear view of the sky • Verify the lock status of GPS satellites (this can be done with PocketMAX)
No heading or incorrect heading value	• Check CSEP value is fairly constant without varying more than 1 cm (0.39 in). Larger variations may indicate a high multipath environment and require moving the receiver location • If heading is calculated then lost at consistent time intervals recalibrate the tilt sensor with $JATT,TILTCAL command

Table A-1: Troubleshooting

Symptom	Possible Solution
No beacon lock	• Beacon reception capability is only present on V110 model • Verify that the receiver is tuned to the correct frequency and bit rate • Ensure that beacon signal coverage is expected in your area • Make sure that environmental noise is not masking the signal, reducing the SNR reading
No DGPS position in external RTCM mode	• Verify that the baud rate of the RTCM input port matches the baud rate of the external source • Verify the pin-out between the RTCM source and the RTCM input port (transmit from the source must go to receive of the RTCM input port and grounds must be connected) • Ensure corrections are being transmitted to the correct port. Using the $JDIFF,PORTB command on Port A will cause the receiver to expect the corrections to be input through Port B
No SBAS lock	• Verify V100's clear view of the sky • Verify the lock status of SBAS satellites (this can be done with PocketMAX - monitor BER value) • Set SBAS mode to automatic with the command $JWAASPRN,AUTO

Table A-1: Troubleshooting

Symptom	Possible Solution
No heading or incorrect heading value	• Heading is from Primary to Secondary antenna, so the arrow on the underside of the V100 should be directed to the bow side • $JATT,SEARCH command forces the V100 to acquire a new heading solution (unless gyro is enabled) • Enable GYROAID as this will give heading for up to 3 minutes in times of GPS signal loss • Enable TILTAID to reduce heading search times • Monitor the number of satellites and SNR values for both antennas within PocketMAX. At least 3 satellites should have SNR values above 20

Appendix B: Specifications

B: Specifications

Table B-1 on page 66 through Table B-6 on page 68 provide the V100's communication, beacon sensor, GPS sensor, mechanical, power and environmental specifications.

Table B-1: Communication specifications

Item	Specification
Serial ports	2 full duplex RS-232 and 2 half-duplex RS-422
Baud Rate	4800 to 38400
Correction I/O protocol	RTCM SC-104, L-Dif (Hemisphere GPS proprietary)
Data I/O protocol	NMEA 0183, binary, Crescent binary, L-Dif (Hemisphere GPS proprietary)
Heading warning I/O	Open relay system indicates invalid heading

Table B-2: Beacon specifications (V110 version)

Item	Specification
Channels	2-channel, parallel tracking
Frequency	283.5 to 325 kHz
Operating modes	Automatic (signal strength or range) and manual
Compliance	IEC 61108-4 beacon standard

Table B-3: GPS sensor specifications

Item	Specification
Receiver type	L1, C/A code with carrier phase smoothing
Channels	Two 12-channel, parallel tracking (two 10-channel when tracking SBAS)
Update Rate	Standard 10 Hz, optional 20 Hz
Horizontal accuracy	< 1.0 m (< 1.09 yd) RMS (DGPS)* < 2.5 m (< 2.7 yd) RMS (autonomous, no SA)**
Heading accuracy	< 0.50° RMS
Pitch/roll accuracy	< 1° RMS
Rate of turn	90°/s max
Start up time	< 60 s typical
Heading fix	< 20 s
Satellite reacquisition	< 1 s
Compass safe distance	125 cm (49.2 in)

***Note:** Depends on multipath environment, number of satellites in view, satellite geometry, baseline length (for local services) and ionospheric activity.

****Note:** Depends on multipath environment, number of satellites in view and satellite geometry.

Table B-4: Mechanical specifications

Item	Specification
Enclosure	UV resistant, white plastic (AES HW 600G) (Non-corrosive, self extinguishing)
Power/data connector	18-pin, environmentally sealed
Dimensions (not including mounts)	60 cm L x 16 cm W x 18 cm H (23.6 in L x 6.3 in W x 7.1 in H)
Weight	1.50 kg (3.3 lb)

Table B-5: Power specifications

Item	Specification
Input voltage	10 to 36 VDC
Power consumption	< 5.0 W
Current consumption	< 360 mA @ 12 VDC
Isolation	Power supply isolated from serial ports
Reverse polarity protection	Yes

Table B-6: Environmental specifications

Item	Specification
Storage temperature	-40°C to 85°C (-40°F to 185°F) (Dry and damp heat)
Operating temperature	-30°C to 70°C (-22°F to 158°F) (Dry and damp heat)
Humidity	100% condensing

Note: This is the minimum safe distance measured when the product is placed in the vicinity of the steering magnetic compass. The ISO 694 defines "vicinity," relative to the compass as within 5 meter (5.47 yards) separation.

Appendix C:
Parts List

C: Parts List

Table C-1 and Table C-2 on page 72 provide the V100 parts list.

Note: The V100 parts comply with IEC 60945's section 4.4: "exposed to the weather."

Table C-1: Equipment

Part number	Description	Quantity
627-1106 (603-1002)	Base mount (Hemisphere GPS logo) (Base mount without branding)	One
627-1109 (603-1001)	Pole mount (Hemisphere GPS logo) (Pole mount without branding)	One
804-0035	V100	One
804-0040	V110	One
Note:	The kit will include one of the V100 or V110, depending on what you ordered	

Table C-2: Accessories

Part number	Description	Quantity
051-0157	15 m V/MV cable ***cable is optional**	One
051-0158	30 m V/MV cable ***cable is optional**	One

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